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54. Device for heating and humidifying respiratory gases

The invention relates to a device for the heating and humidifying of respiratory gases which is located between a Y-piece or non-return respiration valve of a respiration system and a patient. The device consists of a housing with a cylindrical heat and moisture exchange element and a patient connection located in a housing base and a unit connection located in the housing cover. Between the patient connector and the heat and moisture exchange element there is a sputum trap to capture coughed-up solid particles in the expiration gas flow. It consists of an insert with a funnel that is provided with fins and that extends into the interior of the heat and moisture exchange element and an annulus that is located in the housing bottom, is provided with fins and surrounds the patient connection.
The insert is arranged in the housing so that gas passages are formed between the housing and the patient connection and the housing wall.

Description

This invention relates to a device for the warming and humidifying of respiratory gases which is located between a Y-piece or non-return respiration valve of a respiration system and a patient, and consists of a housing with a cylindrical heat and moisture exchange element.

The respiratory gas humidifying and warming is one of the most important tasks in the artificial respiration of patients in the context of intensive therapy, in particular when the patients have been intubated or given a tracheotomy. As a result of the intubation and tracheotomy, the natural humidifying and warming organs of the human body, namely the nose and pharynx, are eliminated from the respiration circuit. Therefore the conditioning of the respiratory gas must be replaced by quasi-artificial organs.

A group of devices characteristic of the prior art are heat and humidity exchangers. DE-OS 28 51 564 describes a device for the heating and humidification of a respiratory gas for a patient which is located in a housing which contains, in a gas line that leads to the patient and to a respiratory gas reservoir, a moisture storage device that is made of gas-permeable, hygroscopic material. The moisture storage device is realized in the form of a hollow cylinder, the interior of which is in communication with the gas line that leads to the patient. The hollow cylinder consists of two layers, in which the material of the inner layer has larger pores than the material of the outer layer. The outer layer is made of visco-cellulose and is used exclusively as a moisture storage device.

The inner layer can be, for example, an acrylic felt and can function both as a moisture storage device and as a heat sink, because the material has relatively large pores. When the patient exhales, the exhalation gas flows through the gas line into the interior of the hollow cylinder and through its two layers, whereby in them it gives up a large percentage of the moisture and heat contained in the exhaled gases. When the patient inhales, dry inhalation gas flows from the respiratory gas reservoir from outside through

the hollow cylinder and absorbs the stored heat and moisture. The hollow cylinder can be replaceable if necessary.

Within the system of technical means for the realization of the artificial respiration of the patient, the heat and moisture exchanger is the element that is most closely associated with the patient and the function of which is therefore exposed to the greatest risk by reactions from the patient. In spite of intensive and optimal medical and chemotherapeutic measures, it cannot be ruled out that during the respiration process, the patient will cough and expel sputum during the cough. Because, in the interest of achieving a small dead space and small overall size of the unit, the heat and moisture exchanger is generally designed with small dimensions and is at the limit of the allowable resistance, there is a danger that the sputum will soon irreversibly clog the cross section. That represents an extreme risk to the patient, and the heat and moisture exchanger must be replaced immediately. In general, this situation is not indicated immediately by the monitoring of the respiration system because the sensors that are required for that purpose are located on the other side of the connection of the heat and moisture exchanger.

The goal of the invention is to prevent life-threatening risks for the patient during the respiration process when heat and moisture exchangers are used.

The object of the invention is to configure the device for the heating and humidification of respiratory gases with a cylindrical heat and moisture exchange element so that the heating and humidification device can be prevented from getting clogged with sputum when the patient being respirated coughs and the operating time of the unit can be extended.

The invention teaches that there is a sputum trap inside the housing of the device for the heating and humidification of respiratory gases between [insert and?] the patient connection. *[Translator's Note: sic - between the patient connection and what is unclear. Words in square brackets added.]* Preferably the sputum trap can consist of an insert

with a funnel that projects into the interior of the heat and moisture exchange element and an annulus that is provided with fins and is located in the housing bottom, whereby the insert is arranged in the housing so that gas passages are formed between the insert and the patient connection and [between the insert and?] the housing wall. *[Translator's Note: The German text is ambiguous and unclear in its use of the word "between". It literally says: "... whereby the insert is arranged in the housing so that gas passages are formed between the latter and the patent connection and the housing wall.]* One or more fins can be located in the funnel of the insert. During exhalation, the exhaled air that enters at the patient connection first enters the funnel of the insert. If the exhaled air is carrying solid particles, said particles can be precipitated in the chambers of the funnel, which can particularly be the case if the patient coughs. In the funnel, there is a change in the direction of the air current, which now enters the annulus that is located in the bottom of the housing. At this point, additional solid particles can be precipitated out. This exhalation process is also connected with moisture deposits. In the annulus, the air current once again changes direction, and travels through the gas passage between the housing and insert into the air space which surrounds the cylindrical heat and moisture exchange element in a ring shape. The exhaled gas flows radially through the heat and moisture exchange element from outward toward the inside, so that, cooled and discharged of its moisture, the gas leaves the housing axially through the unit connection. The dry and cool inhalation gas from the respiration unit or from the environment passes over the heat and moisture exchange element in the reverse direction. The air, which is heated and humidified in the heat and moisture exchange element, absorbs additional moisture as it flows through the sputum trap, so that it finally exits at the patient connection bearing the maximum quantity of heat and moisture.

The invention is explained in greater detail below on the basis of one exemplary embodiment which is illustrated in the accompanying drawings, in which:

Figure 1 shows a heat and moisture exchanger

Figure 2 shows a section A from Figure 1, and

Figure 3 shows a section B from Figure 1.

The device illustrated in Figure 1 for the heating and humidification of respiratory gas consists of a housing 1 with a cylindrical heat and moisture exchange element 2. In the housing bottom 3 there is a patient connection 4. The housing 1 is detachably connected with a housing cover 5. The detachable connection can be realized, for example, in the form of a press-fit or snap-on connection. The housing cover 5 is provided with a unit connector 6. As also shown in Figure 2, in the housing bottom 3 there is an annulus 7 that surrounds the patient connection 4, and is provided with a plurality of fins 8. Figure 3 shows an insert 9, with, in the center, a funnel 10, e.g. in the form of a truncated cone, that extends into the interior of the heat and moisture exchange element. In the funnel 10, there are also fins 11. The insert 9 with the funnel 10 and the annulus 7 provided with fins 8 in the housing bottom 3 form a sputum trap. The insert 9 is oriented in the housing 1 such that it forms a gas passage 12 toward the housing bottom 3, and a plurality of gas passages 13 toward the housing 1. Between the housing 1 and the cylindrical heat and moisture exchange element 2, a ring-shaped air space 14 is formed, which is closed by the housing cover 5. The outer layer closer to the patient of the heat and moisture exchange element 2 is a wire mesh 15 and the inner layer farther from the patient is made of a hygroscopic material 16, e.g. a filter felt. On the side of the housing bottom 3 facing the heat and moisture exchange element 2 and of the housing cover 5 there are guide bevels 17 which center the heat and moisture exchange element 2 in its position. The housing cover 5 is advantageously detachably connected, e.g. by means of a press fit or snap-on connection, with the housing 1. The housing parts and the insert 9 can be made of a heat-resistant, transparent plastic. It is thereby possible to check the level in the sputum trap. The housing parts can be re-used after being sterilized, and only the heat and moisture exchange element 2 needs to be replaced.

The essential advantage of the solution taught by the invention is that solid particles that are present in the exhaled gas are separated in the finned spaces in the immediate vicinity of the patient connection, before the exhaled gas flows through the heat and

moisture exchange element 2. A clogging of said heat and moisture exchange element 2 is thereby prevented, its useful life is extended and risks to the patient are avoided. Simultaneously the finned spaces with their enlarged surface area make possible increased precipitation of moisture and heat storage during the exhalation and increased delivery of moisture and heat during inspiration, thereby improving the basic function of the device.

Nomenclature

1	Housing
2	Heat and moisture exchange element
3	Housing bottom
4	Patient connection
5	Housing cover
6	Unit connection
7	Annulus
8	Fins
9	Insert
10	Funnel
11	Fins
12	Gas passage
13	Gas passage
14	Air space
15	Wire mesh
16	Hygroscopic material
17	Guide bevels

Claims

1. Device for heating and humidifying respiratory gases which is located between a Y-piece or non-return respiration valve of a respiration system and a patient and consists of a housing with a cylindrical heat and moisture exchange element and a patient and unit connection, characterized in that between the patient connector (4) and the cylindrical heat and moisture exchange element (2) there is a sputum trap.

2. Device as claimed in Claim 1, characterized in that the sputum trap consists of an insert (9) with a funnel (10) that extends into the interior of the heat and moisture exchange element (2) and an annulus (7) that is located in the housing bottom (3) and is equipped with fins (8), whereby said insert (9) is oriented in the housing (1) so that gas passages (12, 13) are formed between it and the patient connection (4) and [the insert and?] the housing wall.

3. Device as claimed in Claims 1 and 2, characterized in that one or more fins (11) are located in the funnel (19) of the insert (9).

1 page of drawings